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Network characteristics and the adoption of organizational innovation in the food sector

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Abstract

The purpose of this article is to assess the impact of network characteristics on non-technological, i.e. organizational innovations (hereafter OI), adopted by food companies. In the food sector context, we specifically put forward the importance of partnerships and networking activities, where this question is relevant. Indeed, relatively little is known about the importance of network characteristics, such as the diversity of partners or categories of networks (business clubs, technology parks, industry associations...), for the adoption of OI (organizational innovations). Based upon a sample of 348 European food companies we were able to test hypotheses linking network characteristics with the adoption of OI in the food sector. The results of the research highlight the positive effects of network competence, of heterogeneity of members and of the category of club networks on the adoption OI by food companies.

Keywords: adoption, food sector, organizational innovation, network

1 Introduction

The purpose of this article is to assess the impact of network characteristics on non- technological, i. e. organizational innovations, adopted by food companies. These arguments concerning the importance of networks for innovation may be applied to both technological and non-technological innovation situations. However, there are a limited number of researchers who have investigated the impact of networking behavior on the specific case of OI. OI is a new way to organize activities (Schumpeter, 1983), as “the implementation of a new organizational method in business practices of the company, the organization of work or external relations” [OECD, (2005), p.17] or what is new for a venture is not necessarily new for the market (Daft, 1978). For Le Roy et al (2013) “even if an innovation has already been created in another context, when it is implemented in a company, it is an innovation because it changes the usual way of doing something” [Le Roy et al., (2013), p.78]. Young (2001) argues that the impact of network characteristics on OI is not the same in these two types of OI. Related literature generally views networks and external resources as an important determinant of OI adoption (Damanpour and Aravind, 2012a; Damanpour and Schneider, 2006; Young et al., 2001, Qian et al., 2013; Aravind et al., 2014). We will see that the literature specialized in the food sector also is moving in that direction.

Within this tradition, we specifically put forward the importance of partnerships and networking activities for OI adoption in the food sector, where this question is accurate and has two advantages. Firstly, because this category of innovation for this sector is an important vector of development and competitiveness; and secondly, because the food sector mainly consists of SMEs who massively mobilize the support of networks and partnerships, which suppose the acquisition of managerial knowledge frequently out of reach of these companies. Moreover, some researches propose that the organizational innovation may facilitate other categories of innovation such as technological ones. In this context, relatively little is known about the importance of network characteristics such as the diversity of partners or categories of networks (business clubs, technology parks etc.). Based upon a sample of 348 European food companies we were able to test the relationships between the characteristics of networks and the adoption of OI in the food sector. The article is organized as follows. Firstly, the concept of organizational innovation (hereafter OI) is defined and we have replaced it in the network context of the adoption by firms in general and the research hypotheses are proposed (2). Then the methodology is developed and the data used is detailed (3). The results concerning the research hypotheses are developed (4), followed by a discussion (5) and then by managerial implications (6). Concluding comments follow (7).

2 Organizational innovations and networks in the context of food sectors

In the first part, we detail the concept of OI and the interests of considering it, following major authors on that topic, OI as a category of innovation on its own (2-1). In the second point, we develop the specificity of innovation and networks in the context of food sector (2-2). Finally, we detail the specificity of OI in relation with the network/networking activity concepts and we present our research hypotheses (2-3).

2-1 The concept of organizational innovation: definition and interests

Multiple terms are used to define non-technological innovations: administration innovation, organizational innovation, management innovation and managerial innovation. Amongst the wide diversity of terms used by researchers who have dealt with this category of non-technological innovations, three terms were specifically identified and reviewed: managerial, management and organizational innovation (Damanpour and Aravind, 2012a; Vaccaro et al., 2012; Scarbrough et al., 2015; Camisón and Villar-López, 2014). The conceptualization of innovations as organizational, managerial and administrative is not yet stabilized. However, similarities in terms of definitions and variables studied in empirical works lead to the same concept. There is a novel dimension that is dominant. Also, these innovations are characterized by the invention, adoption, implementation of the best practices and new management methods for the organization. For better readability, in this article we have chosen the term of organizational innovation (named OI) as the adoption and implementation by a company of new practices and management methods that contribute to the objectives of the organization (Damanpour and Aravind, 2012a). Organizational innovation changes how managers seek to meet and exceed performance goals of the venture by introducing new management practices (Mol and Birkinshaw, 2009).

Organizational innovation has been considered as antecedent as well as a consequence of technological innovation. However, most of empirical research focuses on the role of

organizational innovation that has enabled technological innovations to succeed (Damanpour and Aravind, 2012a; Le Bas et al., 2015; Camisón and Villar-López, 2014). For Damanpour and Evan (1984) OI tends to trigger and amplify technological innovation, more than technological innovation triggers and amplifies organizational innovation. This approach introduces the idea of a hierarchy between technological innovation and organizational innovation. Thus, OI is sometimes placed at the top of the hierarchy of different types of innovations. Therefore, technological innovation is considered less powerful than managerial innovation because the previous only produces short-term competitive advantages, whereas the latter produces long-term benefits. Another so-called integrative approach declares that all types of innovations are combined simultaneously - to improve business performance (Roberts and Amit, 2003; Damanpour et al., 2009). According to this approach, organizational and technological innovation may be considered as two aspects of organizational ambidexterity (O'Reilly and Tushman, 2013). Hence, combining the positive effects of these innovations can improve overall performance (Roberts and Amit, 2003; Damanpour et al., 2009). Also, these two types of innovations encompass a single phenomenon (Hervas-oliver et al., 2012; Reichstein and salter, 2006; Schmidt and Rammer, 2007) or could be complementary, once the performance from combined adoption exceeds their adoption in isolation (Schmidt and Rammer, 2007; Battisti and Ionna, 2009; Evangelista and Vezzani, 2010).

The positive effect of organizational innovation on business performance or productivity has already been proven (Mazzanti, Pini and Tortia, 2006; Mol and Birkinshaw, 2009). As a determinant of organizational innovation, several factors are studied in the empirical and theoretical research of this domain. Organizational and managerial characteristics such as top management support, technological competencies, (Damanpour and Aravind, 2012a; Bolívar-Ramos et al., 2012), organizational learning (Liao et al., 2012), Human Resource Management practices (Jiang et al., 2012) and absorptive capacity of firms are some of these factors. The importance of each determinant depends upon the type of organizational innovation. In the

literature of this domain we can find two types of innovation: exploration and exploitation. Based on March (1991) configuration, Damanpour and Aravind (2012a) distinguishes these two types of organizational innovation, regarding the creative process and the source of new ideas. Although firms are said to be innovative, organizational innovation as a process has to be distinguished between generation and/or adoption (Damanpour and Aravind, 2012a). Indeed, some companies adopt managerial innovations generated by others without creating any innovation. In the exploitation process of OI, firms look for a new idea from external sources and adopt this idea for solving an internal problem. In the exploration process, firms create a new idea for an organizational problem and diffuse it in their networks. Birkinshaw and Mol (2006) propose a five-phase process for exploitive OI in which firms look for solution from an external source and adopt it after internal and external validation. Birkinshaw et al. (2008) propose a four-phase process of explorative OI. In this view, the new idea for OI comes from internal sources of firm. These two types of OI have not only a different creating process and source, but different motivations for engaged firms. Firms create an explorative OI in order to solve a real problem and to improve efficiency, while in the case of OI adoption the real motivations of firms are, mostly, fashion trends and legitimacy seeking (Abrahamson, 1996; Westphal et al., 1997). This motivation leads firms to be influenced by the institutional environment in the process of OI adoption (Qian et al., 2013; Aravind et al., 2014).

2.2 Innovation and networks in the context of food companies

While the existence and importance of networks has been widely observed in various types of business sectors, the importance of networks in the innovation processes has been particularly acknowledged in the literature about food SMEs. Sarkar and Costa (2008) for instance suggest that chain actors in the food sectors, considering the highly complex needs of consumers and legislators constraints, new technology trends have to opened up to external sources of knowledge, leading to a so called “open innovation model”. They emphasize the fact that this

trend is not very well known, with little empirical evidence on real practices when it comes to networking activity. Nevertheless, it is clear that the concept of “networked innovation” (XXX, 2014) in the age of the knowledge economy has become a dominant paradigm. Many researchers in the past fifteen years, have explored different facets of this phenomenon, even if, as shown in a recent survey (Tell et al., 2016) the role of the inter-organizational context for innovation processes in the food sectors is not yet elucidated.

For instance, several research works have shown specific aspects of networking activity and their partners and how this will clearly affect innovation. Batterink et al. (2010) for instance show that innovation brokers have positive impacts on innovation when they take the lead in specific functions such as initiation, network composition and process management. In a similar vein, Lefebvre et al. (2013) focus their research on one type of network partners, NAO (Network Administrative Organization). They show that NAOs have a crucial role in building social capital. To do so these NAOs should focus on three actions, creation of boundary objects, selection of members and communication. Gellynck et al. (2007, 2011) focus not on network partners but on networking activity in suggesting that networking among vertical network members contributes most to the enhancement of the innovation capacity of food SMEs.

2.3 The network dimension of organizational innovations: research hypotheses

Innovation networks bring several benefits to firms: risk sharing, access to new markets and technology, acceleration of the path from idea to product to market, pooling of complementary skills, safeguarding of property rights, and a key vehicle for obtaining access to external knowledge. Indeed, the literature of innovation networks has mainly focused on product

innovation (Pittaway et al., 2004). Access to external sources of knowledge and information is crucial for both technological and non-technological innovations (Ganter and Hecker, 2013; Laursen and Salter, 2006; Mol and Birkinshaw, 2009). However, in the case of technological innovations it has been demonstrated that the existence of a critical threshold, where openness to external sources of knowledge, would have a negative effect on performance (Laursen and Salter, 2006). Indeed, a broad openness would overburden firms with knowledge and ideas that they would not necessarily have the capacity to absorb (Cohen and Levinthal, 1990). Such as for technological, product and process innovation, networks may facilitate the creation and diffusion of OI. However, a limited number of empirical researchers have studied the impact networks on OI (Damanpour and Schneider, 2006; Camisón et al., 2016; Perez Jolles et al., 2016; Peng et al., 2014). Pittaway et al. (2004) indicate that “while process and organizational innovation may be, by their very nature, more difficult to study, the types of networking activity occurring in the development diffusion and implementation of process and organizational innovation warrant serious attention”. Peng et al. (2014) argue that interpersonal networks may increase the individual creativity and thereby facilitate the generation of new ideas for OI. Ali et al (2016) highlight the role of the absorptive capacity of firms in the generation and adoption of OI. Absorptive capacity allows firms to capture knowledge and ideas from external sources. For Camisón et al. (2016) participation in a network brings to firms the capability for both explorative and exploitative OI. The positive impact of external knowledge sources on non- technological innovation has already been demonstrated (Huang and Rice, 2012; Mol and Birkinshaw, 2009; Ganter and Hecker, 2013). Birkinshaw et al. (2008) emphasize the role of external agents. More generally, the combination of knowledge is essential to OI (Damanpour and Aravind, 2012a), for the adoption of any other innovations. Pittaway et al. (2004) argue that the principal question for research in the domain of innovation networks is not the importance of networks in firm’s innovation, but the role of a firm’s position and network configurations in innovation. The works of Provan, Fish and Sydow (2007) is of particular interest here. Indeed, this is the fact that

networks as a whole have been under estimated, especially the question of network structures and properties. In the words of Provan et al. (2007), the question of size and diversity of members should be considered in their links with outcomes (for instance innovation). Phelps, Heidl and Wadhwa (2012) follow a similar approach in their work.

Considering the existence of explorative/exploitive or radical/incremental OI (Damanpour and Aravind, 2012a; Camisón et al., 2016) we can assume that these different types of innovation may be facilitated by several types of networks. On the one hand, explorative innovations require exploration networks in which a mix of redundant and non-redundant ties helps firms to overcome the knowledge distance (Gilsing and Duysters, 2008; Gilsing et al., 2008). Based on this argument it could be expected that the generation of OI occurs in small networks with a limited number of strong ties. In line with this argument, Peng et al. (2014) shows the importance of centrality of individuals in their social networks and its impact on individual creativity and OI generation.

Exploitive innovations, on the other hand, require exploitation networks. These types of networks can be recognised as large networks with a large number of non-redundant and informal ties (Gilsing et al., 2007). Adoption of OI requires these kinds of networks. Community learning, proposed by Perez Jolles et al. (2016) may be an appropriate network to the diffusion and adoption of OI. Daft (1978) proposed a top-down mechanistic structure for the adoption of OI and his idea has been confirmed by other empirical studies (Damanpour and Aravind, 2012a). While Daft's theory concerns the organizational structure, we can develop and adopt it for network structures. As indicated above, by the adoption of OI firms seek legitimacy. Institutional pressure leads firms to participate in networks and adopt OI (Ashworth et al., 2009; Qian et al., 2013; Aravind et al., 2014). As an exploitive network, this network

contains heterogeneous partners such as consulting agents, early adopters, institutions (Damanpour and Aravind, 2012a; Damanpour and Schneider, 2006; Young et al., 2001, Qian et al., 2013; Aravind et al., 2014) suppliers, distributors and customers (Ganter and Hecker, 2014).

These arguments lead us to highlight the importance of exploitation networks in the adoption of organizational innovation and to formulate the hypotheses concerning the links between network configuration and organisational innovation, with the specific application to the food sector:

Hypothesis 1: heterogeneity of network membership facilitates the adoption of OI in firms.

Hypothesis 2: heterogeneity of network partners facilitates the adoption of OI in firms.

Hypothesis 3: firms with a high level of network competencies are more successful in the adoption of OI

Hypothesis 4: informal ties in networks facilitate the adoption of OI in firms.

As is mentioned above, exploitation networks are recognised through a large number of non-redundant ties and a combination of formal and informal ties (Gilsing et al., 2007; Gilsing and Duysters, 2008; Gilsing et al., 2008). According to this approach, heterogeneity of network membership, heterogeneity of network partners, as well as informal ties in networks, show the different dimensions of exploitation networks in this research.

3- Methodology, data and variable

A data set of 348 European food firms is used in this research. This data comes from the collaboration of five universities and research centers in five European countries (Belgium, France, Ireland, Italy and Sweden) within the framework of a European FP7 project called NETGROW (2010 to 2014). The objective of the project was to improve the innovation capacity of agro-food firms. An electronic survey was created on the basis of the literature on innovation networks and was sent to 7965 agro-food firms from these five countries. The types of

innovations in the questionnaire had been clearly stated and identified, especially with regard to managerial/organizational innovations. The companies received the questionnaire in their national language. This data can be considered as multicultural data. It is interesting to notice that, due to the scarcity of data on organizational innovation (Damanpour and Aravind, 2012a), data of CIS (Community Innovation Survey) has been the most exploited data by European researchers (Battisti and Stoneman, 2010; Evangelista and Vezzani, 2010; Ganter and Hecker, 2013; Mol and Birkinshaw, 2009; Mothe and Nguyen Thi, 2010; Schmidt and Rammer, 2007). In this sense, our database contributes to diversifying the source material. Moreover, the originality of our data lies on the one hand in the sectoral approach of the food sector, and on the other hand on a special range of size (below 500 employees) of the company, which is also taken into consideration unlike the CIS data. Thus, this sectoral focus brings more relevance and precision for this specific sector. The repartition of 348 European food firms is presented in the table 1.

Insert table 1 here

Concerning the validity of the research questionnaire, three experts from each country were mandated to verify this validity. The reliability of the questionnaire was tested by the Cronbach alpha test with a Cronbach alpha coefficient of 0.75. Our questionnaire is statistically reliable with a coefficient of up to 0.8 based on standardized elements.

Operationally, the survey was conducted over a six-month period from October 2012 to March 2013. During this survey, we sent the questionnaire to 7965 companies in the food sector. A recall process had been put in place (three reminders per company) by e-mail and telephone.

The average response rate was 4.5 per cent and the number of questionnaires returned (finished) per country was as follows: Belgium 81, France 126, Ireland 43, Italy 48 and Sweden 50. This low response rate led us to conduct a nonresponse bias analysis for our data. During the data collection period, we recalled three times by e-mail and telephone and acknowledged two waves of responses during this period. The first wave occurred between October 1, 2012 and January 30, 2013, during which 110 completed questionnaires were received. The second wave concerns the period from 1 February 2013 to the end of March 2013. We received 238 completed questionnaires during this second period. The t test of the mean difference between the observations of these two waves of responses shows no significant difference between the respondents concerning the main variables. Table 2 presents the results of the nonresponse bias analysis for our data.

Insert table 2 here

We studied the impact of network structures on organizational innovation (OI) of firms. The endogenous variable of our empirical models is the OI of firms. The values are: 0 if there is no innovation, 1 if there is one innovation, 2 if there are two innovations, 3 if there are three, four or five and 4 if there are six or more innovations. Table 3 presents our dependent, independent and control variables.

Insert table 3 here

“Organizational innovation” is the dependent variable of proposed models. It represents the quantity of organizational innovation and, as indicated in table 3, it is an ordinal variable. Heterogeneity of firm’s partners (*Partner Diversity*), heterogeneity of networks in which the firm

participates (*Network Diversity*) and network competencies of firms (*Network Competencies*) are proposed as determinants of organizational innovation. We also tested the impact of network type on organizational innovation. In the research questionnaire, we distinguished five types of inter-organizational networks. Empirical tests proposed the importance of three of them in organizational innovation: business clubs (*Business Club*), scientific and technological parks (*Technology Park*) and industrial associations (*Industry Association*). We integrated these variables as exogenous variables in our models. Firm size (*Size*), the age of a firm (*Age*) and the presence of a firm on international market (*International Market*) are used as control variables in empirical models. In table 3 we clarified the measurement of each variable through its definition and the question to which the variable is related.

4. Results

Table 4 shows the bivariate correlation between variables. We can consider a positive and significant correlation between organizational innovations on the one hand, and heterogeneity of partners, diversity of firm's networks, firm's membership in industry associations and business clubs on the other hand. Firm size is significantly correlated with all dimensions of networks: heterogeneity and diversity of partners and networks. Firms which participate in industry associations, participate in heterogeneous networks too.

Insert Table 4 here

Table 5 represents empirical findings of the research. Model fitting information for all models shows that our empirical model is reliable and the dependant variable (organizational innovation)

can be explained through the proposed models. Both indicators of Goodness-of-Fit (Pearson and Deviance) indicate that the used data fits with the empirical models (the value of significance exceeds 0.05). The test of parallel lines confirms that parameters (independent variables value) remains the same in different categories of dependent variable. Nagelkerke R square indicates that between 11 to 14 percent of dependent variable variation can be explained by the proposed empirical models.

Insert Table 5 here

Heterogeneity of firm's partners impacts positively on the organizational innovation of a firm (all models). The more heterogeneous the firm's partners in innovation, the more innovative this firm is in terms of organization and management. Network competence also has a positive impact on the organizational innovation of firms. Firms that are prepared for partnership and that have more experience and knowledge concerning networking behaviour, may benefit more from networks and thereby have more organizational innovations. The heterogeneity of networks in which the firm participates in, does not have a significant impact on organizational innovation. We tested the interaction between network competence and heterogeneity of the network. This interaction has a positive impact on the organizational innovation of firms. This finding means that the network competencies of firms moderate the relationship between heterogeneity of networks in which the firm participates in and its organizational innovation. Firms with a high level of network competencies may benefit more from the heterogeneity of networks in matter of organizational innovation. The membership of firms in a business club impacts positively on the quantity of their OI adoption. This result shows that the informal ties which are formed around the formal network facilitate the knowledge sharing and thereby reinforce OI adaptation. As a control variable, the firm's size has a positive impact on organizational innovation. Large firms always suffer from structural rigidity and need organizational innovation in order to solve

this problem. A firm's age has a negative impact on organizational innovation. Incumbent firms adopt more the best practices of their industries and their intensity of organizational innovation decreases over time. The presence of firms in international markets impacts positively on their organizational innovation. International markets lead to different dimensions of competition for firms and consequently, they will need more innovative practices and structures to overcome this competition.

5. Discussion

Based on Damanpour and Aravind (2012a) classification, in this research we distinguished two types of organizational innovation: exploration OI and exploitation OI. We argued that organizational innovations can be recognised as an exploitation innovation. By definition, an OI is the adoption of new managerial tools and best practices in organization. On the one hand, this category of innovation, as a process, requires the use of external sources as well as institutional influence and support (Birkinshaw and Mol, 2006; Abrahamson, 1996; Westphal et al., 1997; Qian et al., 2013; Aravind et al., 2014; Ashworth et al., 2009). This argument may illuminate the important role of partnerships and of networks in this innovation process.

This point is of particular relevance to the food sector in which the proportion of SMEs is particular high. Consequently, as it has been widely acknowledged in the literature, the use of partners and innovation networks is of specific relevance (Batterink et al., 2010; Capitano et al., 2009).

On the other hand, as an exploitation process, OI needs a special configuration of network: an exploitation one. This kind of network can be recognised by a large number of non-redundant and informal ties as well as structural holes and bridge ties, as suggested by several researchers (Gilsing and Duysters, 2008; Gilsing et al., 2008; Gilsing et al., 2007). Our empirical findings confirm the above arguments. We find that the heterogeneity of the partners impact positively the OI within firms. The study shows that the heterogeneity of network partners facilitates the

adoption of OI in firms (hypothesis 2). Gilsing and Duysters (2008) argue that in the case of a large knowledge distance between partners, firms need redundant ties to understand required knowledge and thus, will exchange information intensively. A wide range of diversified knowledge may prevent firms from developing their exploration process. But in the exploitation process, firms have a limited knowledge distance and are able to receive and internalise heterogeneous knowledge from heterogeneous partners. However, the impact of network diversity on organizational innovation is not significant and thereby our first hypothesis (the heterogeneity of networks membership facilitates the adoption of OI in firms) cannot be confirmed. We find also a positive impact of network competence on OI: this result is in the line with our hypothesis 3 (firms with a high level of network competencies are more successful in the adoption of OI). Regarding the nature of sharing knowledge in the exploitation process, a high level of network competence may be essential for firms (XXX, 2015). In this process firms need to share in-depth knowledge and need also to evaluate the value of received knowledge through triangulation (Doménech and Davies, 2011). Our result confirms also that informal ties in networks facilitates the adoption of OI in firms (hypothesis 4) and shows the positive impact of the business clubs on OI. Indeed, business clubs provide an opportunity for interactive learning for firms through intensive exchange, training, development sessions and meetings (Hyde et al., 2003). These types of interactions always create trust-based informal ties. Informal ties facilitate the innovativeness of firms at the individual level (Tortoriello and Krackhardt, 2010). It has been shown that top managers' attitude towards innovation is one of main determinants of OI (Damanpour and Schneider, 2009). Business clubs reinforce this innovativeness of top management teams and in return this innovativeness facilitates OI. The question of the specificities of the food sector regarding this point is also worth emphasising. We suggest that, with a high proportion of SMEs in the food sector in Europe, our results put the accent on this point for the importance of networks such as business clubs and the prevalence of informal trust-based relationships between managers (Gellynck and Kühne, 2010), as key drivers of OI.

Finally, the presence of firms in international markets positively impacts their OI. As a result, we can understand the existence of a significant link between OI and the competitive environment, with the fact that companies operating in competitive markets are more prone to innovate. On the contrary, uncompetitive markets can create inefficiencies that are considered as bureaucratic and counterproductive in terms of innovation (Damanpour and Aravind, 2006). According to Schmidt and Rammer (2007), customer pressure can be seen as an opportunity and an incentive to innovate. For these authors, a dependence on customers shows a positive effect on OI. In line with these works (Schmidt and Rammer, 2007; Battistti and Iona, 2009; Mol and Birkinshaw, 2009), we can also confirm the positive impact of the firm's exporter status.

6. Managerial implications

This discussion also provides interesting insights for management scholars and practitioners. The adoption of OI is an attracting topic for managers. Our result shows the positive impact of these types of networks on the OI. Business Clubs are an interesting type of network for leaders. Indeed, there is a collective interest of companies for the exchange and sharing aspects of good practices. It pushes them to gather together: emulation, sharing success stories and seeing the difficulties and challenges of others. Realizing that others have the same issues is a source of relief. Beyond simply sharing good practices, comparing oneself to others is a trigger and a vector that positively drives top managers towards improved managerial practices. Indeed, the adoption of new managerial tools and best practices within the firm may facilitate the enhancement of the firm's performance and sustainability.

Our findings may be very useful to firms, and more specifically SMEs, as they constitute the bulk of companies in the food sectors, and in the case in which they rely on networks to create or to adopt OI. In order to realize a successful OI adoption, firms need a special kind of network: an exploitation one. Heterogeneity of partners in networks may facilitate the adoption of OI. Knowledge and information sharing with suppliers, costumers, competitors, firms from other

sectors - enhances the capacity of firms in the adoption of OI. Our findings highlight the important role of network competence in the successful adoption of OI. We argue that the improvement of network competence through structural change and training programs may facilitate the learning by interaction in the case of OI adoption. Among the different types of networks the business clubs are the most interesting. The presence of simultaneous formal and informal ties of this kind of network may improve the innovativeness of managers and lead them to a successful process of OI adoption.

7. Concluding remarks and perspectives

We can summarize what we learn from this research about the importance of the network, as well as its characteristics for innovation organization, in the context of food sector. The network characteristics that positively impact the OI are the heterogeneity of partners and the network competence of firms, as well as the type of networks (particularly business clubs). We analyzed the case of the OI adoption in food companies. However, our empirical model explains a small part of the variation of OI in studied firms. It is due to our particular focus on the networking behavior of firms. In fact, regarding the OI, a wide range of determinant factors are recognized and studied in previous researches. Top management support, technological competencies, organizational learning, HRM practices, a competitive environment, absorptive capacity, firms governance, and change agents are some of these factors (Damanpour and Aravind, 2012a; Bolívar-Ramos et al., 2012; Derdick et al. 2015; Liao et al., 2012; Jiang et al., 2012; Fay et al., 2015; Ganter and Hecker, 2013). Including these determinants may improve the estimation capacity of empirical models. Nevertheless, the integration of all the determinants in a singular model is impossible. Another interesting direction for future research may be the investigation of the role of relational characteristics such as trust, interpersonal exchanges, emotional energy and intensive interaction (Hackett and Parker, 2016), as well as the external agent (Birkinshaw 2014) in the creation and adoption of OI. Finally, we suggest exploring more widely the

specificities of the food sector, and especially the fact that, as we have suggested and made in the hypothesis, the results may be partially linked to the existence of an over representation of SMEs in that sector, in comparison with other sectors having a higher proportion of large and multinational companies. Comparative and inter sectors analysis would be an interesting perspective for further research on network characteristics and organizational innovations in general.

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Table 1: firms' size in research sample

Below 50	255	73.3%
Between 50 and 250	74	21.3%
Between 250 and 500	19	5.4%
Total	348	100%

Table 2 : non-response bias analysis (Independent Samples Test)

Type of Variable	Variables	Early answers- Late answers	N	Mean	Std. Deviation	Levene's Test for Equality of Variances			t-test for Equality of Means		
							F	sig	t	df	sig
Dependent variables	Organizational innovation	0	91	1,10	0.12	Equal variances assumed	2.042	0.154	0.869	299	0.386
		1	206	1,27	0.16	Equal variances not assumed			0.856	224.921	0.393
Main determinant	Network Diversity	0	104	0.86	0.94	Equal variances assumed	0.08	0.78	0.38	339	0.71
		1	237	0.81	0.94	Equal variances not assumed			0.38	196.57	0.71
	Partner Diversity	0	110	3.28	2.46	Equal variances assumed	0.31	0.58	-0.08	346	0.94
		1	238	3.30	2.40	Equal variances not assumed			-0.08	207.93	0.94
	Industry Association	0	101	2.31	1.74	Equal variances assumed	0.03	0.86	0.85	321	0.4
		1	222	2.14	1.67	Equal variances not assumed			0.83	186.85	.41
	Technology Park	0	88	0.17	0.70	Equal variances assumed	5.83	0.02	-1.17	291	0.25
		1	205	0.30	0.96	Equal variances not assumed			-1.32	222.41	0.19
	Business Club	0	95	1.03	1.55	Equal variances assumed	0.03	0.86	0.07	303	0.95
		1	210	1.02	1.60	Equal variances not assumed			0.07	186.66	0.95
	Network Competencies	0	96	0.77	1.24	Equal variances assumed	1.54	0.22	-1.00	318	0.32
						Equal variances not assumed			-1.05	202.28	0.3

Table 3 : variables and definitions			
	Variables	Definition	Question
Dependent variables	Organizational innovation	Number of organizational innovation of firms in ordinal scale (0 if no innovation, 1 if one innovation, 2 if two innovation, 3 if three, four or five innovation and more innovation and 4 if six and more innovation)	Q12-4
Main determinants	Partner Diversity	Heterogeneity of partners in the networks from with which the firm shares resources	Q14
	Network Diversity	Heterogeneity of networks in which the firm participates	Q13
	Network Competencies	Number of activities that the firms realises in order to develop its network competence	Q18
	Business Club	Number of business clubs in which the firm's managers participate	Q13-5
	Technology Park	Number of scientific and technological parks in which the firms participate	Q13-4
	Industry Association	Number industry associations in which the firms participate	Q13-2
Control variables	Size	The number of firm's employees	Q37-2
	Age	The age of firm	Q37-1
	International market	The presence of firm in international market (1 if yes and 0 if no)	Q5

Table 4 : bivariate Correlations between variables

	Network Diversity	Partner Diversity	Network Competencies	size	age	Industry Association	Technology Park	Business Club	Organizational innovation
Network Diversity	1.000								
Partner Diversity	0.290**	1.000							
Network Competencies	0.120*	0.216**	1.000						
Size	0.353**	0.234**	0.279**	1.000					
Age	0.155**	0.006	0.091	0.372**	1.000				
Industry Association	0.623**	0.163**	0.089	0.308**	0.169**	1.000			
Technology Park	0.344**	0.139*	0.137*	0.147*	0.053	0.073	1.000		
Business Club	0.542**	0.096	0.034	0.059	-0.070	0.222**	0.058	1.000	
Organizational innovation	0.166**	0.176**	0.070	0.176**	-0.008	0.125*	0.117	0.170**	1.000

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Table 5 : empirical models, ordinal regression						
		Model 1	Model 2	Model 3	Model 4	Model 5
Type of variable	Variables	Org. innov	Org. innov	Org. innov	Org. innov	Org. innov
Main determinant	Partner Diversity	,119** 3,865	,106* 3,007	,084 2,137	,108* 3,074	,104* 2,985
	Network Diversity	-,061 ,092	-,125 ,371	,186 2,564	-,157 ,557	
	Network Competencies				,212** 4,087	
	Net. Diversity * Net. Competencies					,082** 3,871
	Business Club	,254** 6,069	,293*** 7,605		,275*** 6,465	,205** 5,797
	Technology Park	,174 ,949	,187 1,093		,240 1,648	,126 ,589
	Industry Association	,058 ,296	,053 ,244		,094 ,718	,001 ,000
Controls variables	Size	,238** 5,367	,207** 3,922	,246** 6,170	,195* 3,361	,203** 3,706
	Age	-,216 2,026	-,223 2,117	-,304** 4,238	-,222 2,139	-,224 2,183
	International Market		,555* 3,569	,467* 2,916		
Model fitting information	Model fitting Chi-Square	28,068**	31,71***	27,869***	29,91***	29,379***
	Nagelkerke R ²	0,12	,135	,110	,134	,132
	Goodness-of-Fit Pearson	997,890 ,778	930,866 ,989	1025,263 ,989	1006,684 ,214	986,798 ,372
	Goodness-of-Fit Deviance	461,821 1,000	458,184 1,000	496,897 1,000	442,467 1,000	442,993 1,000
	Test of Parallel Lines	18,131 ^c ,641	5,855 1,000	12,113 ,670	25,03 ,404	21,539 ,426
	Number of observation	348	348	348	148	348